DETERMINING THE EXPANSION RATE OF AN INVASIVE TREE PEST

JAMIE P MCKEOWN[1]

Abstract

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Keywords: Key words

MSC Classification: Classification

Some ideas

Misc notes

We can consider the following:

- Two models: M1 constant-coefficient model.
- Inference for "both" models - summarise paper 1 results for homogeneous model. / or maybe just pick some parameters and leave inference for follow up paper?
  - Compare models using the DIC
  - Posterior predictives for both? Using half the number of test sites (4 each - 2023, 2019, 2015, 2010)
- Approaches for calculating the speed of propagation:
  (1) Convex hull decomposition and geodesic distance (heat method): using supremum/maximum of distance to hull vertices.
  (2) Tanh fit and midpoint trajectory: again, using maximum
  (3) 8-point compass of speeds: using maximum along given directions (for convex hull, use $\frac{\pi}{8}$ radian arcs, for tanh fit, use the specific cross sections $(y=0)^+, (y=0)^-, (x=0)^+, (x=0)^-, (y=x)^+, (y=x)^-, (y=-x)^+, (y=-x)^-$)
  (4) For each of these two approaches, we will measure distance from two sources: a single point source (the centre of the initial state) and from the (edge of the) initial territory we obtain from our circle fit. For CH/GD, this defines a (generalized) Dirac function that's fed directly into the heat method. For tanh fit, single point -

(A1) School of Mathematics, Statistics, and Physics, Newcastle University, Newcastle upon Tyne, UK.
E-mail address: j.p.mckeown2@ncl.ac.uk.
Date: September 21, 2025.

measure distance from that point; initial state - measure distance from centre and subtract radius of circle.

Methods for determing the position of the front

(1) Convex hull.
(2) Tanh fit along one-dimensional cross sections
(3) Circle fit (a la Suprunenko)

Methods for determing rate of expansion/propagation

(1) Geodesic distances via the heat method / linear rate of spread a la Mineur et al 2010
(2) Measuring distance traversed by midpoint of the tanh fit? / linear rate of spread a la mineur et al 2010
(3) Maximum distance method (and potentially others quoted in Suprunenko et al 2021 / Preuss et al 2014
(4) 95th gamma quantile (Preuss et al 2014)
(5) Infested area? a la Hill et al 2001 / accumulation of occupied grid squares a la Mineur et al 2010